



STARTER FOR 10...

0.2.8. Moles and mass

One mole of a substance is equal to 6.02×10^{23} atoms, ions or particles of that substance. This number is called the **Avogadro constant**.

The value of the Avogadro constant was chosen so that the relative formula mass of a substance weighed out in grams is known to contain exactly 6.02×10^{23} particles. We call this mass its **molar mass**.

We can use the equation below when calculating an amount in moles:

$$\text{amount of substance (mol)} = \frac{\text{mass (g)}}{\text{molar mass (g mol}^{-1}\text{)}}$$

How is a mole similar to a dozen?



Stating the amount of substance in moles is just the same as describing a quantity of eggs in dozens. You could say you had 24 or 2 dozen eggs.

Use the equation above to help you answer the following questions.

- Calculate the amount of substance, in moles, in: (3 marks)
 - 32 g of methane, CH_4 (molar mass, 16.0 g mol^{-1})
 - 175 g of calcium carbonate, CaCO_3
 - 200 mg of aspirin, $\text{C}_9\text{H}_8\text{O}_4$
- Calculate the mass in grams of: (3 marks)
 - 20 moles of glucose molecules (molar mass, 180 g mol^{-1})
 - 5.00×10^{-3} moles of copper ions, Cu^{2+}
 - 42.0 moles of hydrated copper sulfate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
- 3.09 g of a transition metal carbonate was known to contain 0.0250 mol.
 - Determine the molar mass of the transition metal carbonate. (1 mark)
 - Choose the most likely identity for the transition metal carbonate from the list below:

CoCO_3	CuCO_3	ZnCO_3	(1 mark)
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 - 4.26 g of a sample of chromium carbonate was known to contain 0.015 mol. Which of the following is the correct formula for the chromium carbonate? (2 marks)

CrCO_3	$\text{Cr}_2(\text{CO}_3)_3$	$\text{Cr}(\text{CO}_3)_3$
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BONUS QUESTION

If you had 1 mole of pennies which you could share with every person on earth how much could you give each person?
Approximate world population = 7 500 000 000.





STARTER FOR 10...

0. TRANSITION SKILLS Answers

0.2.8. Moles and mass

- $32.0 \text{ g} \div 16.0 \text{ g mol}^{-1} = 2 \text{ mol}$ (1 mark)
 - $175 \text{ g} \div 100.1 \text{ g mol}^{-1} = 1.75 \text{ mol}$ (1 mark)
 - $0.2 \text{ g} \div 180.0 \text{ g mol}^{-1} = 0.0011 \text{ mol}$ (1 mark)
- $20 \text{ mol} \times 180 \text{ g mol}^{-1} = 3\,600 \text{ g}$ (1 mark)
 - $5.00 \times 10^{-3} \text{ mol} \times 63.5 \text{ g mol}^{-1} = 0.318 \text{ g}$ (1 mark)
 - $42.0 \text{ mol} \times 249.6 \text{ g mol}^{-1} = 10\,500 \text{ g}$ (1 mark)
- $3.09 \text{ g} \div 0.0250 \text{ mol} = 123.6 \text{ g mol}^{-1}$ (1 mark)
 - CuCO_3 (1 mark)
 - molar mass of chromium carbonate = $4.26 \text{ g} \div 0.015 \text{ mol} = 284 \text{ g mol}^{-1}$ (1 mark)
 $\text{Cr}_2(\text{CO}_3)$ (1 mark)

BONUS QUESTION

$6.02 \times 10^{23} \text{ p} \div 7\,500\,000\,000 \text{ people} = 8.03 \times 10^{13} \text{ p per person}$ or 803 000 million pounds per person!

0.2.9. Moles and concentration

- $1.5 \text{ mol} \div 0.25 \text{ dm}^3 = 6.0 \text{ mol dm}^{-3}$ (1 mark)
 - $0.25 \text{ dm}^3 \times 0.0150 \text{ mol dm}^{-3} = 3.75 \times 10^{-3} \text{ mol}$ (1 mark)
 - $0.125 \text{ mol} \div 0.85 \text{ mol dm}^{-3} = 0.15 \text{ dm}^3$ (1 mark)
- $5.0 \text{ g} \div 84.0 \text{ g mol}^{-1} = \underline{0.0595 \text{ mol}}$ (1 mark)
 $0.0595 \text{ mol} \div 0.100 \text{ dm}^3 = \underline{0.60 \text{ mol dm}^{-3}}$ (1 mark)
 - $0.025 \text{ dm}^3 \times 3.8 \text{ mol dm}^{-3} = \underline{0.095 \text{ mol}}$ (1 mark)
 $0.095 \text{ mol} \times 40.0 \text{ g mol}^{-1} = \underline{3.8 \text{ g}}$ (1 mark)
 - $2.5 \text{ g} \div 129.9 \text{ g mol}^{-1} = \underline{0.0192 \text{ mol}}$ (1 mark)
 $0.0192 \text{ mol} \div 1.3 \text{ mol dm}^{-3} = \underline{0.015 \text{ dm}^3}$ (1 mark)
 $0.0148 \text{ dm}^3 = \underline{15 \text{ cm}^3}$ (to 2 sig. fig.) (1 mark)



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